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CO-OPERATIVE EFFORT IN A NEW SPECIES OF TUBE DWELLING WORM, *EUNICE METATROPOS* (POLYCHAETA:EUNICIDAE)

J. RUSSELL HANLEY
Northern Territory Museum of Arts and Sciences,
GPO Box 4646, Darwin, NT 5794, Australia.

ABSTRACT

Eunice metatropos sp. nov., a species of eunicid polychaete from Western Australia, is described and illustrated. It is compared with other species of *Eunice* Cuvier which also inhabit tough pliable parchment-like tubes. Unlike other tube dwelling eunicids, all twelve specimens had acted in concert during the early stages of tube building, entwining the tubes together for about one third of their length. After this initial phase each tube separates and diverges from the others producing a remarkable tree-like structure.

KEYWORDS: Polychacta, Eunicidac, *Eunice metatropos*, new species, unusual tubes, Western Australia.

INTRODUCTION

An aggregation of worm tubes were presented to me reeently by a colleague, Mr Wayne Houston who came upon them while sorting material eollected by trawl from the north-west shelf off the eoast of Western Australia. At first he thought it was a "gorgonian" because of its tree-like habit, however, closer inspection revealed a group of parchment-like tubes inhabited by polychaete worms.

Unfortunately, as the material has been frozen before fixation in formalin the eunieid worms extraeted from the tubes are generally in poor condition. There is however, enough material to allow the eonclusion the specimens represent a hitherto undeseribed spccies.

SYSTEMATICS

Eunice metatropos sp. nov.

(Figs 1-3)

Type material. HOLOTYPE - Northern Territory Museum (NTM) W3886, northwest shelf off western Australia, 19°12.0'S 118°32.0'E, stn 85-5, eoll. observer crew, bzcp "Chieh Fa" No 1, depth 80 m, 1 July 1985. PARATYPES - NTM W 3887, NTM W 3888, NTM W 3889, NTM W 3953, United States National Museum (USNM) 101342, USNM 101343, Australian Museum (AM) W 201437, AM W 201438, British Museum of Natural History (BMNH) ZB 1986-251, BMNH ZB 1986-250, data as for holotype.

Description. The holotype is complete and has 87 segments. The body is flesh-coloured with reddish-brown longitudinal blazes of pigment on the dorsal surfaces of anterior segments.

The prostomium is shorter than wide, bilobed anteriorly with indistinct palps (Figs 1A, 2B). Two eyes are present lateral to the bases of the inner lateral antennae. The eye pigment is reddish-brown and faint in the holotype. The five antennae are smooth with swollen bases; the single median antenna is 2.14 mm long, the inner lateral pair are shorter measuring 1.32 and 0.94 mm, the outer lateral pair are the shortest at 0.74 and 0.78 mm. The first peristomial ring is cylindrical and longer than the prostomium. The second peristomial ring is less than half the length of the prostomium and has a pair of dorsal cirri measuring 0.42 and 0.38 mm respectively.

Parapodia are uniramous (Figs 1B,C, 2 C, D) Anterior parapodia are low, rounded becoming more prominant and triangular posteriorly. The dorsal cirri are digitiform. The ventral cirri are stouter, shorter, conical and from about setiger 10 have a proximal pad. Ventral cirri retain proximal pads on all posterior segments.

Branchiae are present from setiger 6 to setiger 60. The maximum number of branchial filaments is 3 and this is the number found on the majority of middle body segments. Branchiae are absent from the posterior body segments.

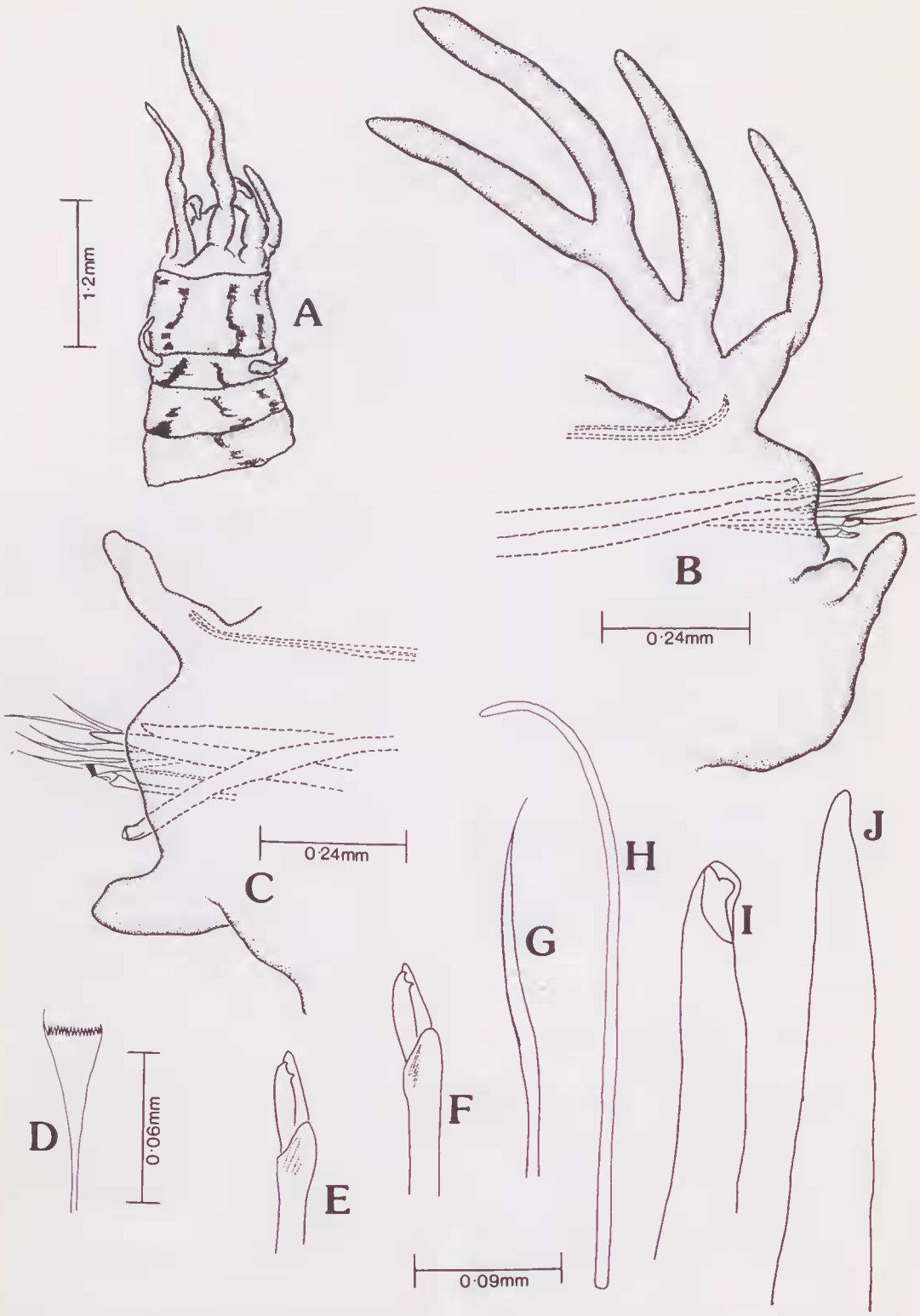

Fig. 1. *Eunice metatropos* holotype: **A**, anterior end, parapodia cannot be seen in this view; **B**, 27th setiger; **C**, 60th setiger; **D**, pectinate seta; **E**, **F**, falcigers; **G**, unilimbate capillary seta; **H**, notoacicula; **I**, subacicular hooded hook; **J**, neuroacicula. E-J, same scale.

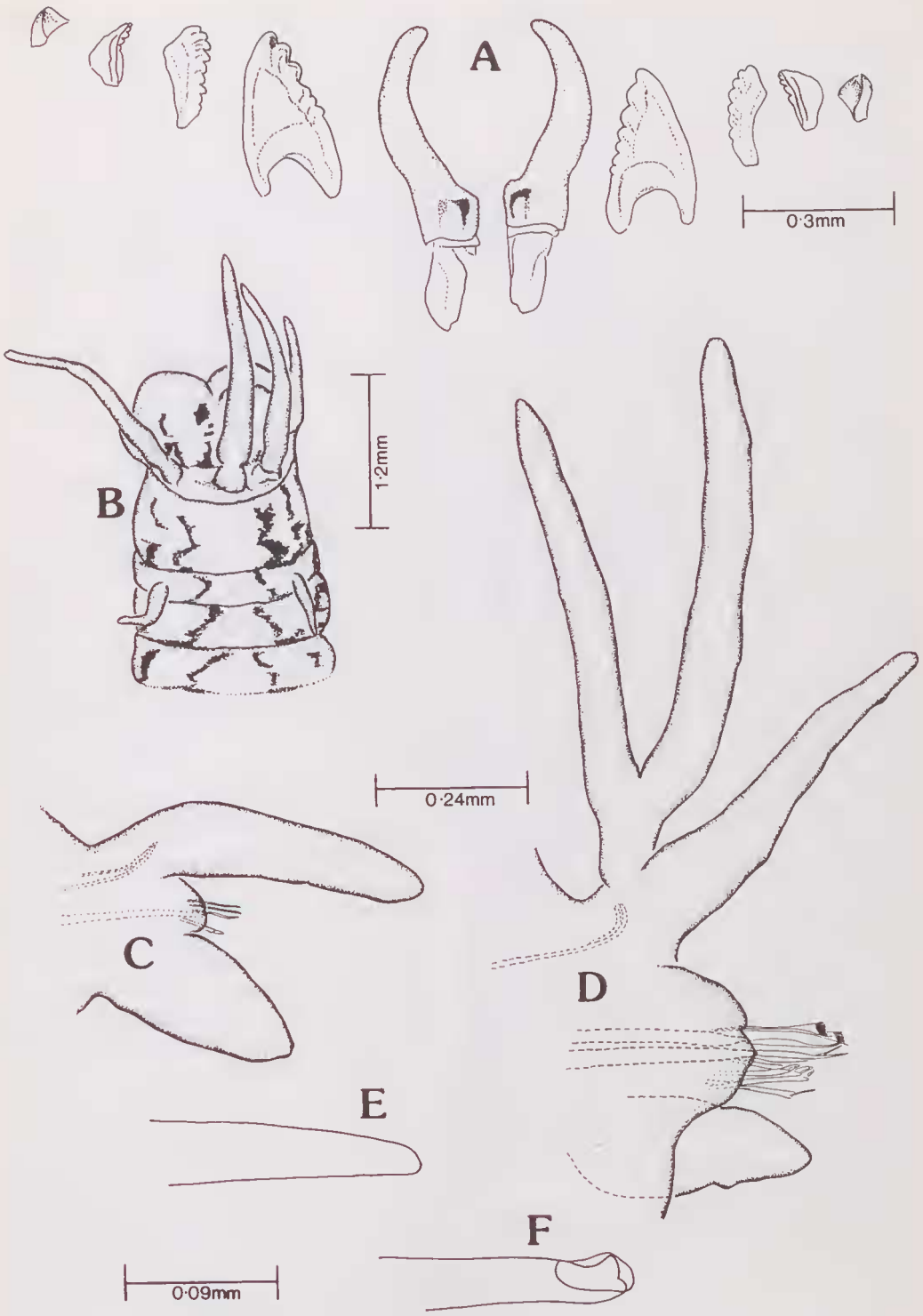

Fig. 2. *Eunice metatropos* paratype, NTM W3888: **A**, exploded view of jaws; **B**, anterior end, parapodia cannot be seen in this view; **C**, first setiger; **D**, parapodium from middle of body; **E**, neuroacicula; F, subacicular hooded hook. E, F same scale.

Table 1. Measurements of the type material of *Eunice metatropos* sp. nov. (— indicates missing or incomplete structures).

Specimen	*Body length (mm)*	*No. of segments*	*Branchiae begin segment No.*	*Antennae length left to right (mm)*	*Tentacular cirri length (mm)*
NTM W3886	37.00	87	7	0.74; 1.32; 2.14; 0.94; 0.78	0.42; 0.38
NTM W3887	44.25 (incomplete)	105	12 on right 8 on left	0.60; 1.16; 2.10; 1.24; 0.62	0.30; 0.44
NTM W3888	60.00	140	8	0.90; 1.66; 1.74; 1.50; 0.88	0.36; —
NTM W3889	50.00	104	8	0.74; 1.68; —; —; —	0.48; 0.50
USNM 101342	(incomplete)	(incomplete)	8	0.72; —; —; —; 0.64	0.32; 0.28
USNM 101343	32.25 (incomplete)	63 (incomplete)	10	0.68; 0.92; 1.80; 1.00; 0.60	0.32; 0.36
AM W201437	38.70 (incomplete)	95 (incomplete)	8	0.54; —; —; —; 0.76	0.32; 0.32
AM W201438	31.80 (incomplete)	71	8	0.68; 1.86; —; 2.00; 0.70	0.54; 0.60
BMNH ZB 1986-250	51.75	120	8	—; —; —; —; —	0.34; 0.52
BMNH ZB 1986-251	52.95 (incomplete)	101	8	0.72; 1.10; 1.36; —; 0.70	0.36; —
NTM W 3953	(incomplete)	91	8	0.50; —; —; 2.08; 0.62	0.54; 0.52

Aciculae are yellow, most with slightly bent tips. There are two in each parapodium except in a few of the posterior parapodia which have a single acicula only. A single yellow bidentate subacicular hook is present in each parapodium from about the middle of the body (Figs 1C, I, 2F). Each setal fasicle usually contains a few capillary setae, several stout, compound falcigers and one to three pectinate (comb) setae (Fig. 1 D-G). The capillary setae are unilimbate with fine serrations. Each pectinate seta has 16-18 teeth, only one margin is extended as a filament and is much longer than the other. The compound falcigers are hooded with straight shafts which are expanded and slightly curved near the distal end. The tips of the compound falcigers are stout; each has a bluntly rounded hood; the distal tooth is only slightly curved and the proximal tooth is triangular and pronounced. In addition each setiger also contains a pair of distinctive yellow notoaciculae which provide support to the base of the dorsal cirri. The notoaciculae are slender and, at their distal end curve upwards into the dorsal cirrus.

The pharyngeal apparatus was dissected in the holotype and one of the paratypes (NTM W3888). The maxillary formula of the holotype is Mx.I=1+1, Mx.II=7+7, Mx.III=9+8, Mx.IV=7+6, Mx.V=1+1. The paratype differs only on the fourth pair of jaws Mx.IV=6+5.(Fig 2A)

Description of Paratypes. Table 1 lists the measurements of all the material. The maximum number of body segments is 140. About half of the specimens are incomplete posteriorly, a reflection of the poor state of preservation.

Tubes. There are 14 tubes present. The walls of the tubes are of the same tough, pliable, parchment type constructed by a number of species of *Eunice* Cuvier. The tubes are entwined for about one third of their length then they separate, producing a tree-like structure (Fig. 3). Each tube is roughly cylindrical for the first, entwined third of its length. Once separated from the surrounding tubes, each tube exhibits the alternate branching or zig-zag appearance seen in the tubes of other Eunice species such as *E. tubifex* (Crossland, 1904). The overall height of the tubes is 170 mm.

Distribution. The species is known only from the type locality, the north-west shelf of Western Australia.

DISCUSSION

Hartman (1944) recognised four major groups in the genus *Eunice* based upon the colour and dentition of the subacicular hooks. Fauchald (1970) adopted this scheme and extended it to cover all known species of *Eunice*. Group A1 of Fauchald's scheme (1970:204) is characterised by species in which the subacicular hooks are yellow and bidentate (Hartman's Flavus-bidentatus group) with branchiae occurring before segment 10 and absent after segment 100. These characters are all found in *E. metatropos* and

Fig. 3. Tubes of *Eunice metatropos*. Maximum height of structure is 170 mm.

accordingly it is placed in this group. Fauchald lists 13 species in group A1. The new species *E. metatropos* differs from all of these in the unusual shape of the notoaciculae which are markedly curved near their tips. In addition the presence of five pairs of symmetrical jaws distinguishes the new species from all other members of the genus, for I can find no reference to this phenomenon in the literature.

Finally there is the nature of the tubes. Few species of *Eunice* construct tough parchment tubes, and none of these species are members of the A1 group. The two species with tubes most like those of *E. metatropos* are *E. tubifex*, *E. tibiana* (Pourtales, 1869) and *E. conglomerans* (Ehlers, 1887). However a comparison with material collected from Northern Territory waters indicates *E. tubifex* has branchiae which begin after segment 10 and continue to the end of the body, and the pectinate setae have fewer teeth (10-12).

E. conglomerans differs in the colour of the subacicular hooks, which are black, and therefore places the species in Fauchald's group B3, in conjunction with the absence of branchiae before segment 10 and their presence thereafter to the end of the body.

E. tibiana was originally described as *Marphysa tibiana* by Pourtales (1869) from 270 fathoms off Cuba. The species is poorly known and Fauchald (1970) indicates the color and dentition of the subacicular hooks are unknown.

The remarkable structure of the entwined tubes warrants further comment as their appearance demonstrates co-operative behaviour in members of this new species. I have observed aggregations of polychaetes among specimens of several species of Serpulidae, Sabellidae, Spionidae, Terebellidae and Nereidae. There are records of polychaete species of these and other families which can be found in dense aggregations with many individuals in close proximity to each other (see Day 1967). However, in these cases, the phenomenon is often the result of environmental conditions which permit the successful settlement of recently metamorphosed juveniles and is often characterised by intense intra-specific competition with mortality the price of failure in the battle for scarce resources (see Woodin 1974 for a review). Indeed such is the level of competition for space (and indirectly, food), that some tube dwelling polychaetes are significant predators on juveniles of their own species (Woodin 1974).

In this new species of eunicid, we have an example of harmony in which each individual apparently exhibits a positive response to the presence of other members of its own species. The entwining of the tubes implies there may be a benefit to be gained by each worm from the association,perhaps from the construction of a rigid base to the tree-like cluster of tubes. Then, suddenly, after showing a positive tropism towards each other during the early stages of tube-building the worms exhibit a negative tropism, and the tubes quickly diverge producing the marvellous "tree" shape.

Whether the structure is deliberate or accidental cannot be determined without additional material. The "tree" may be an aid to feeding, the distal ends of the tubes are flexible allowing the occupants some freedom in foraging. The feeding strategies of most Eunicidae are poorly known, however what we do know of tube-dwelling *Eunice* and the closely related Onuphidae (Day 1967; Fauchald and Jumars 1979) indicates the worms forage over the surface of the substrate surrounding their tubes. Spacing of individuals of these species often reflects this foraging, as the distance between a pair of tubes is presumably the sum of the two radii marked out by the foraging activities of the occupants of those two tubes. The spacing of tubes by the interactions between foraging individuals could explain the orientation of the distal two-thirds of each tube in the aggregation of specimens of *E. metatropos*. Unfortunately, it gives no clue to the reasons for the earlier positive tropism demonstrated by the entwined portions of the tubes. Perhaps the base is the result of the occupants of these tubes all settling after metamorphosis into the same narrow crevice within coral rubble, sponge or other substrate. *E. tubifex* builds a tall flexible tube with its base lying in a crevice in coral rubble. The basal part of the tube is often twisted and looped around itself. However, the basal parts of *E. tubifex* tubes are always very firmly attached to the substrate and are not easily detached. The tubes of this new species show no evidence of attachment to the substrate save for the very base of the structure which is flared

in a manner reminiscent of tree roots and the holdfasts of algae. All indications are, therefore, this is a free-standing structure. Trees and algae have a physiognomy which reflects the forces of wind and water respectively. It may be that the "tree-like" aggregate of tubes of *E. metatropos* is an adaptation to provide rigidity to flexible tubes subject to powerful currents. These same currents may provide an adequate supply of water-borne food to an otherwise overcrowded group of worms.

The name assigned to this species reflects the apparent change in tropism exhibited by individuals of the species during the construction of their tubes.

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